PH.D. DISSERTATION DEFENSE ANNOUNCEMENT

INVESTIGATION OF INFINITE-DIMENSIONAL DYNAMICAL SYSTEM MODELS APPLICABLE TO GRANULAR FLOWS

by
Hao Wu

Ph.D. Candidate in Mathematical Sciences
New Jersey Institute of Technology, Newark NJ

Advisors: Dr. Denis Blackmore

Committee Members:
Dr. Anthony D Rosato, Dr. Lou Kondic,
Dr. Linda J Cummings, Dr. Richard O Moore

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ABSTRACT

Recently Blackmore, Samulyak and Rosato developed a class of infinite-dimensional dynamical systems in the form of integro-partial differential equations, which have been called the BSR models. The BSR models were originally derived to model granular flows, but they actually have many additional applications in a variety of fields. BSR models have already been proven to be completely integrable infinite-dimensional Hamiltonian dynamical systems for perfectly elastic interactions in the case of one space dimension, but the well-posedness question of these systems is at least partially answered for the first time here. In particular, dynamical systems of the BSR type are proven to be well posed under mild auxiliary conditions and shown to have interesting properties. Also included is a novel derivation of a formula for (density) wave speeds in flow fields computed directly from the BSR model. In addition, an innovative semi-discrete numerical scheme for obtaining approximate solutions is described in detail and the questions of consistency, convergence, stability and accuracy of the scheme are treated at considerable length. It is shown how this numerical scheme can be used to help demonstrate the value of these models for predicting the evolution of granular flows and other flow field related phenomena, which is demonstrated to some extent by comparisons of the numerical results with experiments and some DEM simulations.